

**OCHOCO IRRIGATION DISTRICT
OCHOCO MAIN CANAL**

**CANAL LINING DEMONSTRATION PROJECT
Exposed 160-mil Coletanche NTP 2 ES
NOVEMBER 14 - 16, 2000**

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Ochoco Irrigation District

COLAS, (France)

Bureau of Reclamation

Test Section O-5.—

Material:	Exposed 160-mil Coletanche NTP 2 ES
Date installed:	November 2000
Location:	Ochoco Irrigation District – See Figure 1 (700 linear feet; 28,000 square feet)
Description:	Coletanche NTP 2 ES (Coletanche) is an elastomeric bitumen geomembrane, combining Styrene-Butadiene-Styrene (SBS) polymer and asphalt with a polyester reinforcement. COLAS manufactures 5 grades of Coletanche. Only the Coletanche ES is polymer modified. Coletanche is provided in 160-mil thickness, and roll widths of 4 and 5 meters (13 and 16.5 ft). Product data sheet is included in Appendix A.
Prime Contractor:	Ochoco Irrigation District
Material Supplier:	COLAS, (France)
Subgrade prep:	Ochoco personnel performed extensive subgrade preparation by removing vegetation that had overgrown the canal. They removed 6 to 12 inches of mucky sediment and restored the original 1½:1 sideslopes. The cost for extensive subgrade preparation is estimated at \$0.26 per square foot. This subgrade estimate was chosen to match the subgrade costs used on previous similar test sections. The finished canal prism measures about 40 to 42 feet across, including a 1-ft V-notch anchor trench on each bank.
Construction:	Installation began at the downstream end of the test section and proceeded upstream 700 linear feet. The Coletanche was delivered in rolls measuring 5- by 80-meters (16½- by 262-ft), and the rolls were installed across the canal. The Coletanche rolls were handled by a trackhoe equipped with a lifting bar (constructed by the district). The Coletanche was first unrolled 4 to 5 feet by hand, and clamped between 2x4s with a pair of C-clamps. A chain connected the C-clamps to a backhoe on the opposite bank. The backhoe then drove away from the canal, unrolling the Coletanche into place. The Coletanche was then cut to match the canal width, and pulled into final position by a 4-man crew. Adjacent sheets were overlapped 6-12 inches, shingled downstream, and seamed with a propane torch by a 2-man crew. Finally, the membrane was secured in the berm by nailing, and then backfilled with 6-12 inches of cover soil in the V-notch anchor trench. At the upstream and downstream ends of the test section, the Coletanche was buried in a 2-ft by 5-ft wide cut-off trench. The upstream cut-off was backfilled with concrete, while the downstream was backfilled with soil.
Difficulties:	The subgrade was quite irregular with offsets up to 6 inches. Seaming over these large offsets was challenging.
Unit Cost Estimate:	Exposed 160-mil Coletanche = \$1.51 per square foot (\$0.93 Coletanche + 0.26 preparation + 0.10 installation + 17% OH & profit)

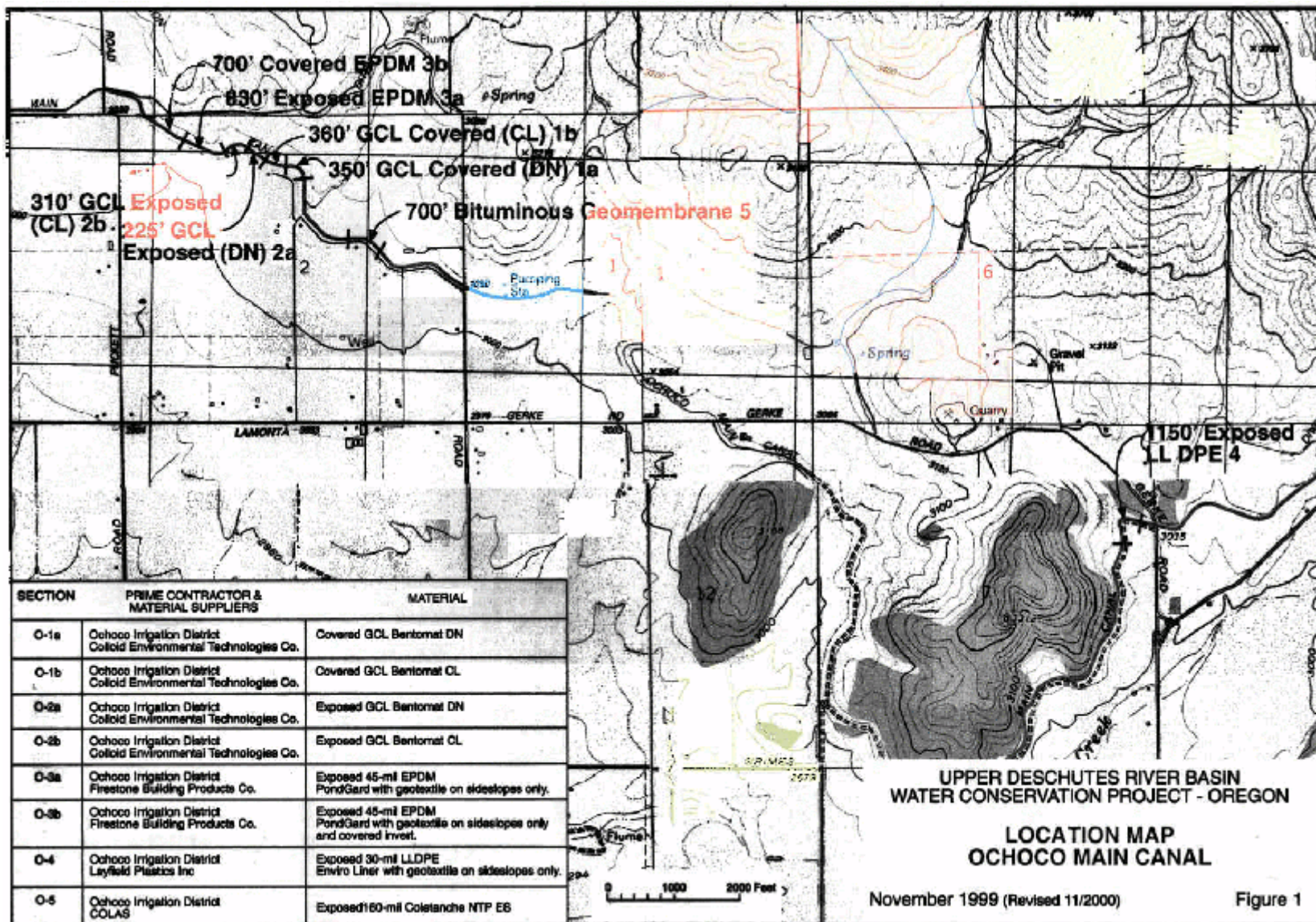


Figure 1- Location Map

Advantages: Coordinating the movements of the Trackhoe and the Backhoe on opposite banks allowed precise positioning of the Coletanche with little to no handling required. Because each panel of the Coletanche was trimmed to match the canal prism, little to no material was wasted. Installation is fast, simple and requires no special equipment. Irrigation districts can install this material with their own forces, and allows flexibility in the construction schedule to accommodate bad weather and fluctuating workload. This crew had experience installing other geomembranes, and was able to install 32,000 square feet (7½ rolls) on the first day. By using their own equipment and labor, the irrigation district was able to install the membrane at significantly less cost compared to hiring a contractor.

Disadvantages: Because the Coletanche is installed across the canal, a transverse seam is needed every 5 meters along the canal. Seaming is rather slow, and 2 seaming crews are needed to keep pace with the installation crew. Exposed geomembranes are susceptible to weathering (especially UV light), animal damage, and vandalism. The Coletanche is UV resistant, and quite tough to resist to animal damage. Based on our experience with similar products, the expected service life is 20 to 40 years.

Photographs: 1 through 23



Photograph 1 - Earthen dike at upstream end of the test section. Preconstruction conditions are visible upstream of the dike.



Photograph 2 - Irrigation district reshaped the canal prism, restored the 1½:1 sideslopes, and cut a 6-inch deep V-notch anchor trench on each bank.



Photograph 3 - Subgrade was quite rough with offsets up to 6 inches.



Photograph 4 - Geomembrane is placed into the cut-off trench at the downstream end of the test section.



Photograph 5 - Concrete placed over geomembrane in the upstream cut-off trench.



Photograph 6 - Completed upstream cut-off trench.



Photograph 7 - Trackhoe unloads rolls of COLAS geomembrane from shipping container.



Photograph 8 - Trackhoe equipped with lifting bar (fabricated by the irrigation district) handles the rolls of geomembrane.



Photograph 9 - Close-up of lifting bar.



Photograph 10 - District used 2x4's and clamps to grip the geomembrane.



Photograph 11 - Geomembrane is pulled off the roll and into the canal.



Photograph 12 - Small frontloader pulls the geomembrane up the far bank and into position.



Photograph 13 - Geomembrane easily supports worker while suspended across the canal.



Photograph 14 - Trackhoe and front loader coordinate precise placement of the geomembrane liner.



Photograph 15 - Overview of liner placement.



Photograph 16 - After positioning, the liner is cut to length with little or no waste.



Photograph 17 - Propane torch used to seam the geomembrane.



Photograph 18 - After heating with the torch, seams are pressed together with a paint roller.



Photograph 19 - Seamer places a large patch over a wrinkled seam caused by uneven subgrade.



Photograph 20 - Ultrasonic equipment was used to test about 10% of the seams. Although all seams were water tight, small voids within the 8 inch overlap were detected due to the uneven subgrade.



Photograph 21 - The grader backfills the V-notch anchor trench.



Photograph 22 - Anchor trench has been backfilled up to the edge of the canal.



Photograph 23 - Finished COLAS test section.

Appendix A

Material Data Sheet

COLAS 160-mil Coletanche NTP 2 ES

TESTS ON BITUMINOUS GEOMEMBRANE Colétanche NTP 2 ES

Type of test and measured properties	Standard	Unit	Test results
Mass per unit area Mass per unit area	ASTM D 5261	g/m ²	5306
Nominal thickness Nominal thickness at 20 kPa	ASTM D 5199	mm	4.41
Tensile <i>Longitudinal direction</i> Break strength Strain at break <i>Transversal direction</i> Break strength Strain at break	ISO 1421	kN/m % kN/m %	26.6 61.7 20.5 69.3
Tear <i>Longitudinal direction</i> Tear resistance <i>Transversal direction</i> Tear resistance	ASTM D 751	N N	164 181
Static puncture (CBR method) Puncture strength Coefficient of variation	EN ISO 12236	kN %	3.6 4.2
Dimensional stability <i>Longitudinal direction</i> Size variation <i>Transversal direction</i> Size variation	ASTM D 1204	% %	- 0.12 - 0.02
Cold bending <i>Longitudinal direction</i> Upper face Lowest temperature (°C) to wrap on a mandrel (φ 20 mm) Bottom face Lowest temperature (°C) to wrap on a mandrel (φ 20 mm) <i>Transversal direction</i> Upper face Lowest temperature (°C) to wrap on a mandrel (φ 20 mm) Bottom face Lowest temperature (°C) to wrap on a mandrel (φ 20 mm)	UNI 8202/15	°C °C °C °C	- 25 - 15 - 25 - 10
Water vapour transmission Permeance Permeability coefficient	ASTM E 96	g/m ² · 24h m/s	0.155 3.66 x 10 ⁻¹⁴

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NUCLEO TERRE, ROCCE E TECNOLOGIE COSTRUTTIVE
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